Quantum Computation with Superconducting Quantum Devices

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web.mit.edu/superconductivity

DURINT 01

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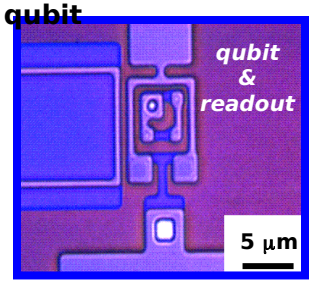
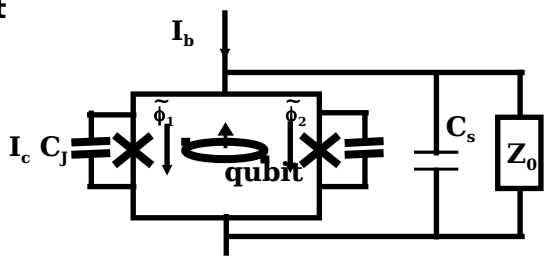
- **Persistent-current qubit**





Fabrication Technology and Modeling of Measurement of Superconducting Qubits

Objective:

To use superconducting loops and Josephson junctions

1. To model the measurement process, understand decoherence, and to develop scalable algorithms,
2. To combine these qubits with classical on-chip, high-speed superconducting control electronics,
3. To implement the fabrication and testing of the superconducting qubits.

Approach:

Theory: To understand the measurement and control processes, develop algorithms and guide the experimental design and testing.

Circuits: To design, analyze and demonstrate superconducting circuitry for the on-chip input and the required control functions for qubit manipulation.

Implementation: To test and analyze results from each integration step; oversee

Accomplishments:

1. Developing the technology base for the Nb fabrication process by demonstrating a flip-chip process, low temperature resistors, on-chip oscillators and RSFQ components,
2. Developing the measurement scheme for a Nb qubit with a Nb dc-SQUID measuring device,
3. Designing and fabricating on-chip experiments using RSFQ circuits,
4. Modeling the environmental noise